Butler Community College
Behavioral Science, Math, Science, and
Physical Education Division

Robert Carlson
Revised Fall 2008
Implemented Fall 2008
Textbook Update Fall 2009

COURSE OUTLINE
Basic Chemistry

Course Description

CH 105. Basic Chemistry. 5 hours credit. Prerequisite: Placement score or MA 060 with a C or better. This course will enable the student to understand the scientific method, improve knowledge of basic math skills, be able to read, communicate, and understand scientific materials, and apply scientific reasoning to real world problems. The student will learn the fundamental principles of general chemistry and basic laboratory techniques. This course is designed for the student who has not taken high school chemistry. A student may enroll in CH 230 after completion of this course. Three hours of lecture/recitation and three hours laboratory per week.

Course Relevance

The impact of chemistry in everyday life is phenomenal. The ability to see chemistry in action on the micro (molecular) and macro scale is necessary to develop a fuller knowledge and understanding of the world around us. Chemistry will enrich the students' appreciation of the world and help them better understand the studies of science and the scientific methods.

Required Materials

Tro. (2008). *Introductory chemistry and mastering chemistry* (3rd ed.). Prentice Hall.

Laboratory Manual: available in ANGEL

Lab kit purchased from BCCC Bookstore.

Microsoft Word or word processing software capable of creating RTF files.

Microsoft Excel or graphical analysis software capable of saving graphs as Web pages.

Learning Outcomes

The intention is for the student to be able to:

1. Understand scientific method.
2. Develop knowledge of basic math skills.
3. Read, communicate and understand scientific materials.
4. Apply scientific reasoning to real world problems.

Learning PACT Skills that will be DEVELOPED and/or documented in this course

Through the student's involvement in this course, he/she will develop his/her ability in the following PACT skill areas:

Personal Development Skills

1. Personal management
   - The student will reflect through either an essay or questionnaire as to how their personal management skills have evolved.

Analytical Thinking Skills

1. Critical thinking
   - The student will demonstrate scientific reasoning through a variety of mathematical, graphical, experimental, and written assignments.

Communication Skills

1. Creation and delivery of messages
   - The student will write a research paper concerning the properties, hazards and uses of an assigned chemical or a biography of a scientist.

Technology Skills

1. General computer use
   - Through electronic-facilitated research, preparing graphs, and the manipulation of data, the students develops basic computer skills.

Major Summative Assessment Task(s)

These learning outcomes and the Learning PACT skills will be demonstrated by:

1. Writing laboratory reports, which include observations, and analysis of the experiment.
2. Completion of the department's comprehensive final exam.
3. Writing a research paper on an assigned topic in chemistry.

Course Content

I. Skills/Competencies – Actions that are essential to achieve the course outcomes:
   A. Apply basic mathematical concepts
   B. Write a research paper
   C. Prepare lab reports
II. Themes – Key recurring concepts that run throughout the course:
   A. Scientific method
   B. Scientific reasoning
III. Issues – Key areas of conflict that must be understood in order to achieve the intended outcome:
   A. The balance between the conceptual and mathematical models
   B. The cumulative nature of science and the world
   C. The cumulative influence of scientific discoveries and the subsequent application of the discoveries
   D. The balance between "wet" lab chemistry and computer interfacing, collection, and analysis of data
IV. Concepts – Key concepts that must be understood to address the issues:
   A. Mathematics
   B. Scientific Method
   C. Scientific Reasoning
   D. Scientific writing
   E. Scientific principles
   F. MLA writing format
   G. Word processing

H. Excel spreadsheet
I. Graphing

Learning Units - Lecture

I. Recognize the three major subatomic particles and their general arrangement in the atom
   A. Structure of the atom
   B. Dalton's atomic theory
   C. Introduction to modern atomic theory

II. Identify an element from its symbol and/or provide a symbol for a given element

III. Relate the properties of the elements to their relative positions in the periodic table
   A. Development of the periodic table
   B. Trends in key periodic atomic properties
   C. Connection between atomic structure and chemical reactivity

IV. Distinguish between ionic, covalent and polar covalent compounds.
   A. Atomic properties and chemical bonding
   B. Ionic bonding
   C. Covalent bonding
   D. Electronegativity and bond polarity

V. Create Lewis electron-dot symbols/formulas for various elements and simple covalent molecules

VI. Recognize shape and determine polarity for simple molecules
   A. Electronegativity and bond polarity
   B. Valence shell electron pair repulsion (VSEPR) theory

VII. Determine the name of a substance given the formula and the formula of a substance given the name
   A. Formulas of compounds
   B. Naming compounds
   C. Writing formulas from names

VIII. Determine the significant digits in a number, including numbers written in scientific notation
   A. Scientific notation
   B. Units
   C. Significant figures

IX. Perform basic calculations on numbers and round off the answers to the correct number of significant digits

X. Make conversions between the English and metric system as well as within the metric system
   A. Units
   B. Dimensional Analysis

XI. Distinguish between the various classes of matter and differentiate between physical and chemical properties and changes
   A. Elements, compounds, and mixtures
   B. Classification and separation of mixtures
   C. Physical and chemical properties and changes

XII. Calculate the energy involved when a substance undergoes a phase and temperature change
   A. Specific heat capacity
   B. Heats of vaporization/condensation and fusion/solidification
   C. Heating/cooling curves

XIII. Calculate the formula or molecular mass of a compound

XIV. Convert between mass, moles, and number of molecules of a substance
   A. Formulas of compounds
   B. The mole
   C. Dimensional Analysis

XV. Perform simple stoichiometric calculations
   A. Dimensional Analysis
   B. The mole
   C. Empirical and molecular formula

XVI. Calculate the percent composition of a compound from its formula or determine the empirical formula from percent composition
   A. Formulas of compounds
   B. The mole
   C. Dimensional Analysis

XVII. Solve stoichiometry problems involving mass-mass, mass-volume, and volume-volume relationships, including limiting reagent problems
   A. Dimensional Analysis
   B. The mole
   C. Calculating amounts of reactant and product
   D. Fundamentals of solution stoichiometry

XVIII. Identify and balance simple chemical reaction equations
   A. Precipitation reactions
   B. Acid-base reactions
   C. Combustion reactions
   D. Synthesis reactions

E. Decomposition reactions

XIX. Predict the products of simple reactions
   A. Precipitation reactions
   B. Acid-base reactions

XX. Know and solve problems involving the relationships between volume, temperature and pressure
   A. Physical states of matter
   B. gas pressure and measurements
   C. Individual gas laws: Boyle's, Charles, Avogadro's
   D. Ideal gas law
   E. Kinetic molecular theory

XXI. Use gas laws
   A. Solve for molar mass
   B. Solve for density
   C. Solve stoichiometry problems

XXII. Identify various intermolecular forces
   A. Physical states and changes
   B. Phase changes
   C. Types of intermolecular forces

XXIII. Calculate the various ways of expressing solution concentration
   A. Molarity
   B. Mass percent

XXIV. Describe and use colligative properties of solutions
   A. Boiling point elevation
   B. Freezing point depression
   C. Solve for molar mass of an unknown solute

XXV. Identify acids and bases and describe the difference between a strong and weak acid and base and recognize reactions of acids and bases
   A. Acids and bases
   B. Acid strength
   C. Water as an acid and a base

XXVI. Distinguish between acidity and basicity on the pH scale
   A. pH scale
   B. buffers

XXVII. Perform simple pH calculations

XXVII. Reference literature sources to gather and summarize information in a written research paper

Learning Units - Laboratory

I. Make observations and measurements, handle data, calculate results, and draw conclusions from observations and/or experimental data

II. Communicate results through written laboratory reports

III. Demonstrate safe work habits in the lab

IV. Construct a graph and interpret graphical data

V. Use titration data to solve stoichiometric problems.

Learning Activities

Independent and collaborative learning activities will be assigned within and outside the classroom and laboratory to achieve the intended course outcomes. Classroom discussion, lecture, drills/skills practice and textbook reading assignments will also contribute to the learning process.

Grade Determination

Grade determination will be based on the research paper, tests, lab reports, and comprehensive final exam. Other methods such as quizzes, homework may be used at the discretion of the instructor. A departmental comprehensive final will be administered at the end of the semester.